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Answer to Case of the Month #154 Osteoid Osteoma

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Clinical Presentation

A 50-year-old woman presented with right shoulder pain after lifting a heavy container. Over the next several months she was unable to work because of the pain. Her past medical history was significant only for a hysterectomy and breast reduction surgery. On physical examination the patient had mild tenderness over the right biceps tendon and a slightly reduced range of motion at the right shoulder. She had no systemic symptoms and no lymphadenopathy. Radiographs of the right shoulder were obtained and are shown in Figure 1. A bone scan showed increased tracer uptake at the right humeral neck. Mammograms and an abdominal and pelvic computed tomography (CT) scan were normal. Magnetic resonance imaging (MRI) of the right shoulder is shown in Figure 2. A CT-guided biopsy of the right humeral neck was performed (Figure 3).

Diagnosis

Osteoid osteoma.

Radiologic and Pathologic Findings

A frontal projection of the right shoulder (Figure 1) shows an ill-defined sclerotic lesion at the proximal metaphysis of the humerus. The upper component of the lesion has a small central lucency that could suggest a nidus of osteoid osteoma, but most of the lesion is atypical for such a diagnosis. In addition, the patient is 50 years old, which is too old for this diagnosis. The MRI images (Figure 2) show a lesion, at the lesser tuberosity of the humerus, of high signal intensity on a T_2-weighted image showed enhancement after gadolinium

Figure 1. Frontal radiograph of the right shoulder.

Key Words: Bone; Radiography; Osteoma; Osteoid.

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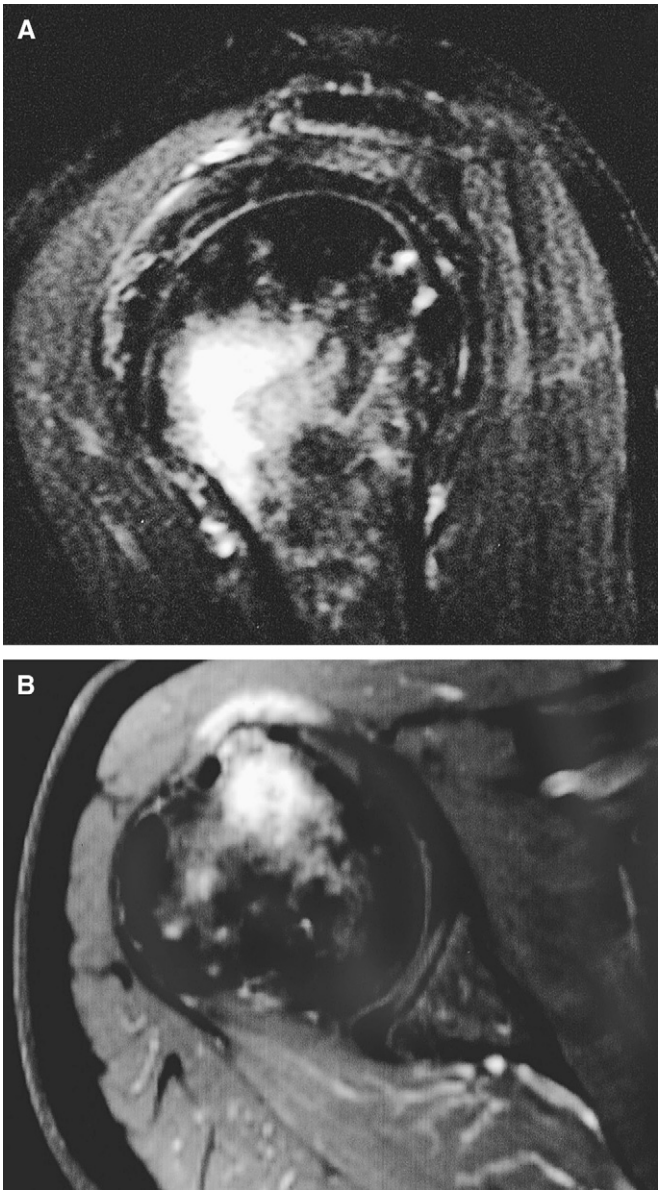

Figure 2. (A) Sagittal T_2 (TR/TE = 4,200/11 ms). (B) Axial enhanced T_1 (TR/TE = 500/15 ms). TR/TE = repetition time/echo time.

injection. There is also a small adjacent focus of enhancement at the periosteum. It was the CT scan images (Figure 3) at the time of the biopsy that strongly suggested the diagnosis of osteoid osteoma, with the presence of 2 niduses surrounded by 2 sclerotic rims at the lesser tuberosity of the humerus. We obtained a good core biopsy specimen that showed a calcified matrix of osteoid tissue, mixed with hypervascular stroma, and occasional osteoclasts and fibroblasts, features highly suggestive of osteoid osteoma (Figure 4).

Discussion

Osteoid osteoma is a relatively common benign skeletal neoplasm. It is usually seen in young patients between the ages of 5 and 25; the average age at presentation was 19 in a large series [1]. There is a male predominance with a ratio

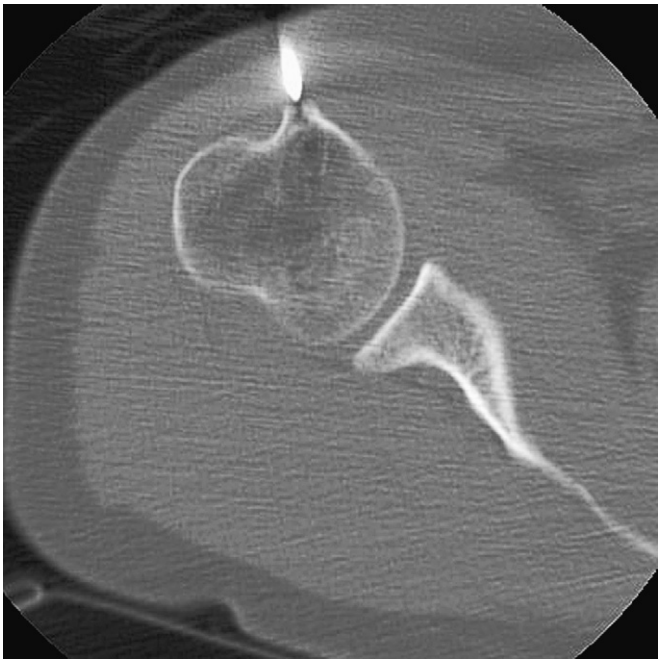

Figure 3. Axial computed tomography cut showing the biopsy needle in place.

of male to female most often reported in the range of 2:1 to 3:1 [1–3]. Lesions most often are located in the cortex of long bones, especially in the lower extremities, but also can be found in the posterior elements of the spine. The most common clinical presentation is localized pain, classically worse at night and relieved by aspirin [1–3]. There may be tenderness and swelling around the site, and occasionally neurologic deficits may be seen [1,2]. Intra-articular lesions may result in joint effusion, stiffness, or arthritis [1,2]. When located in the spine, a painful scoliosis may result [2,3].

Histologically, the nidus of an osteoid osteoma is a small (<1.5 cm) spheric lesion composed of a mix of osteoid and woven bone arranged in trabeculae or lamellae interspersed

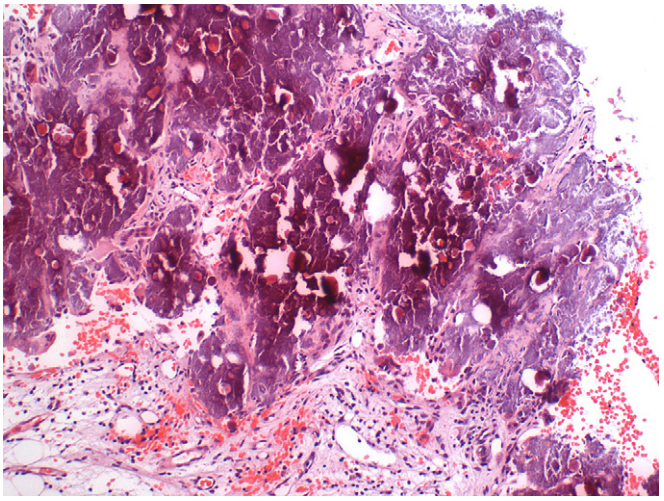

Figure 4. Hematoxylin-eosin stain of the biopsy specimen, 100× magnification.

within loose fibrovascular tissue [1]. Surrounding the lesion, reactive host bone is laid down, composed of dense woven and lamellar bone [1]. Three types of osteoid osteoma have been described [1]. The first type comprises cortical osteoid osteomas, the most common type. They appear as a radiolucent nidus within a thickened fusiform segment of cortex and usually are found in long bones. The second type comprises cancellous/medullary osteoid osteomas. These are associated with milder osteosclerosis, which may appear distant to the site of the lesion. They often are found in the bones of the hand, femoral neck, and the spine. The third type comprises subperiosteal osteoid osteoma, the rarest type. These arise adjacent to the bone and are associated with minimal sclerosis. They often are seen in the hands and feet.

Radiographs are most often the first modality used. Cortical lesions are diagnosed most easily with this modality because they display the characteristic radiolucent nidus surrounded by dense sclerosis [2]. Medullary and subperiosteal lesions are less apparent and have a less-specific appearance. CT is considered the preferred method in diagnosing osteoid osteomas. It is highly sensitive and specific, and furthermore helps in treatment planning. The nidus appears as a low-attenuation area surrounded by high-attenuation reactive sclerosis [2]. In 50% of cases, calcifications in variable patterns are seen within the nidus [1]. On MRI the nidus may be difficult to identify. It appears as a medium-intensity signal on T1-weighted images and as a high-intensity signal on T2-weighted images, enhancing with gadolinium [4]. Surrounding bone marrow and soft-tissue edema may be seen [4]. Bone scintigraphy will show increased uptake at the nidus, which may show a double-density sign—the nidus taking up more tracer due to hypervascularity, with less uptake in the surrounding reactive tissue [1–3].

The differential diagnosis of osteoid osteoma includes osteoblastoma, Brodie's abscess, bone islands, and malignant lesions such as osteosarcoma or metastasis. Osteoblastomas are histologically very similar to osteoid osteomas, although the nidus may appear more uniform and disorganized [2,3]. They are distinguished from osteoid osteomas by their larger size (2–6 cm), predilection for the axial skeleton, and a more aggressive course including a high local recurrence rate and possible malignant transformation [2]. On imaging there is variable sclerosis surrounding the nidus, and there may be cortical bone destruction and more periosteal bone formation than is seen with osteoid osteoma [5]. Brodie's abscess, a type of subacute osteomyelitis, sometimes can be distinguished on imaging by a more irregular shape and by the presence of a sinus tract [2,6]. Enostoses (bone islands), often found incidentally, are densely sclerotic lesions with a spiculated border and usually do not take up tracer on scintigraphy [7]. Primary osteosarcomas occur mostly in young people and appear as large mostly sclerotic lesions that invade adjacent cortex and soft tissue [8]. Secondary osteosarcomas can be seen in older patients, usually as a complication of Paget disease or postirradiation. Bone metastasis is an important diagnosis to consider in older age groups, such as in the case of our patient. Breast cancer can result in multiple osteolytic, osteoblastic, or mixed lesions that usually are multifocal and detectable by scintigraphy [9].

Management of osteoid osteoma has classically been either pain control with anti-inflammatory drugs (some lesions resolve spontaneously over time) or surgical excision. A variety of new procedures have been developed, including ethanol injection, laser photocoagulation, and radiofrequency ablation. CT-guided radiofrequency ablation is being used widely for lesions that are not located in the hand or spine. It involves inserting an electrode into the nidus through a needle cannula and heating the nidus to 85 °C for 5 minutes [10]. Success rates reported vary from 75% to 100% [10].

Successful biopsy with histologic confirmation is not necessary for a diagnosis of osteoid osteoma when the clinical presentation and radiologic signs are clear. In this case, because of the patient's age, this diagnosis originally was considered unlikely. However, multiplanar imaging, particularly the CT scan images, were consistent with a diagnosis of osteoid osteoma, which was confirmed histologically.

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